PROCEEDINGS OF SPIE

Sensors, Systems, and Next-Generation Satellites XXVII

Sachidananda R. Babu Arnaud Hélière Toshiyoshi Kimura Editors

3–6 September 2023 Amsterdam, Netherlands

Sponsored by SPIE

Cooperating Organisations Cranfield University (United Kingdom)

Published by SPIE

Volume 12729

Proceedings of SPIE 0277-786X, V. 12729

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Sensors, Systems, and Next-Generation Satellites XXVII, edited by Sachidananda R. Babu, Arnaud Hélière, Toshiyoshi Kimura, Proc. of SPIE Vol. 12729, 1272901 © 2023 SPIE · 0277-786X · doi: 10.1117/12.3014178 The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings: Author(s), "Title of Paper," in Sensors, Systems, and Next-Generation Satellites XXVII, edited by Sachidananda R. Babu, Arnaud Hélière, Toshiyoshi Kimura, Proc. of SPIE 12729, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X ISSN: 1996-756X (electronic)

ISBN: 9781510666870 ISBN: 9781510666887 (electronic)

Published by **SPIE** P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) SPIE.org Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.



Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

• The first five digits correspond to the SPIE volume number.

• The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

vii Conference Committee

US MISSIONS AND TECHNOLOGY I

12729 04 Advances in small-satellite systems for high-resolution atmospheric sensing: TROPICS and CREWSR (Invited Paper) [12729-2] 12729 05 Hyperspectral Earth imaging in the LWIR and SWIR with the ACMES mission (Invited Paper) [12729-3] 12729 06 The HyTI mission [12729-4] 12729 07 Integrated active thermal control for hyperspectral LWIR imaging on advanced high-powered CubeSat platforms [12729-5] EUROPEAN MISSIONS AND TECHNOLOGY I

- 12729 09 The copernicus hyperspectral imaging mission for the environment (CHIME): an overview of its mission, system and planning status [12729-7]
- 12729 0A The Copernicus land surface temperature monitoring (LSTM) mission: design, technology and status [12729-8]
- 12729 OB Quantum sensing for Earth observation at the European Space Agency: latest developments, challenges, and future prospects [12729-9]
- 12729 0C ALTIUS atmospheric limb sounding mission, a novel hyperspectral imager [12729-10]

JAPANESE MISSIONS AND TECHNOLOGY I

- 12729 OE Overview and current status of GOSAT-GW mission and AMSR3 instrument [12729-13]
- 12729 OF Global and regional CO₂ and CH₄ flux distributions derived from the inversion analyses of GOSAT series data and their temporal variations [12729-14]
- 12729 0G The current status of ALOS-4 [12729-15]

JAPANESE MISSIONS AND TECHNOLOGY II

- 12729 0H From ALOS-2 to ALOS-4: Japan's pioneering L-band SARs for global vegetation monitoring, state-of-the-art and future perspectives [12729-16]
- 12729 01 Conceptual study of the next-generation compact infrared camera [12729-17]
- 12729 0J Feasibility study of green food system support satellite (GreFSat) [12729-18]
- 12729 0K Data downlink prioritization using image classification on-board a 6U CubeSat [12729-19]

US MISSIONS AND TECHNOLOGY II

- 12729 OL The joint NASA/JPL-ASI surface biology and geology thermal infrared (SBG-TIR) project (Invited Paper) [12729-21]
- 12729 00 Pulse response of the shortwave infrared detection system of the ocean color instrument for the NASA PACE Mission [12729-23]
- 12729 OP Measurement techniques for the high-contrast and in-field stray light performance of OCI [12729-24]
- 12729 0Q Applications of T2SL barrier infrared detectors in observational instruments [12729-25]
- 12729 OR GeoXO lightning mapper (LMX) engineering demonstrator unit design and silicon results [12729-26]

EUROPEAN MISSIONS AND TECHNOLOGY II

12729 0S Meteosat third generation (MTG) satellites series overall status: the launch and in-orbit characterisation of the first imagery mission of MTG (Invited Paper) [12729-27]
 12729 0U Night-time remote sensing: understanding the science and measurement challenges [12729-29]
 12729 0V Status on the development of the Copernicus CO2M mission: monitoring anthropogenic carbon dioxide from space [12729-31]

SMALLSAT

12729 OW	Detector characterization and upcoming instrument calibration of an improved version of the five-angle spectro-polarimeter SPEXone [12729-32]
12729 OX	A multispectral polarimetric instrument concept based on metasurface filters [12729-33]

12729 OY Miniature waveguide filters for large-scale terahertz Earth observation [12729-34]

12729 0Z Implementation of the **Φsat-2** on board image processing chain [12729-35]

ON GROUND AND ON ORBIT CALIBRATION I

- 12729 10 Breadboarding and performance testing of a miniaturized stimulus for on-board calibration of space optical instruments [12729-37]
- 12729 12 Ground systems software for automatic operation of the HYPSO-2 hyperspectral imaging satellite [12729-40]
- 12729 13 In-orbit VNIR sensor quality validation [12729-41]
- 12729 14 Satellite lunar observation and analysis [12729-50]
- 12729 15 Snapshot spectral imaging based on SPAD and CS for space targets [12729-59]

ON GROUND AND ON ORBIT CALIBRATION II

- 12729 16 An overview of NOAA-21 VIIRS early on-orbit calibration and performance (Invited Paper) [12729-42]
- 12729 17 Impacts of orbital drift on the MODIS lunar calibration [12729-43]
- 12729 18 Characterization of the VIIRS DNB mid-gain stage using observations of bright stars [12729-44]
- 12729 19 PACE OCI crosstalk characterization based on pre-launch testing [12729-45]

ON GROUND AND ON ORBIT CALIBRATION III

- 12729 1A A numerical model for the ALTIUS instrument performance assessment [12729-46]
- 12729 1B OzFuel: a space-based vegetation fuel flammability monitoring system [12729-47]
- 12729 1C Development of a 1U new space camera for EMCCD and CCD sensors with enhanced low-light sensitivity [12729-48]
- 12729 1D Deep spectral imaging (DSI): an optimized AI-based spectral imaging acquisition, transmission, and calibration [12729-49]

- 12729 1F Introducing the EarthDaily Constellation, a scientific-grade earth observation mission with daily revisit time [12729-52]
- 12729 1G NOAA-21 VIIRS day-night band on-orbit calibration and performance in early mission [12729-53]
- 12729 1H A compact and rugged hyperspectral camera for remote sensing based on FT spectroscopy [12729-54]
- 12729 11 NOAA-21 VIIRS thermal emissive bands on-orbit calibration and performance in early mission [12729-55]
- 12729 1J Active optics for a formation flying synthetic aperture telescope [12729-57]
- 12729 1L Effect analysis of motion compensation on imaging quality of spaceborne coded aperture hyperspectral imager [12729-62]

Conference Committee

Symposium Chair

Lorenzo Bruzzone, Università degli Studi di Trento (Italy)

Conference Chairs

Sachidananda R. Babu, NASA Earth Science Technology Office (United States)
Arnaud Hélière, European Space Research and Technology Centre (Netherlands)
Toshiyoshi Kimura, Japan Aerospace Exploration Agency (Japan)

Conference Programme Committee

Philippe Martimort, European Space Research and Technology Centre (Netherlands)
Josep Rosello, European Space Research and Technology Centre (Netherlands)
Xiaoxiong J. Xiong, NASA Goddard Space Flight Centre (United States)